

Passenger Rail Corridor Study Tucson to Phoenix

RANGE OF ALTERNATIVES TECHNICAL MEMORANDUM

Submitted by:



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Submitted to:



Federal Transit Administration
Federal Rail Administration

Version 1.0 | April 4, 2012

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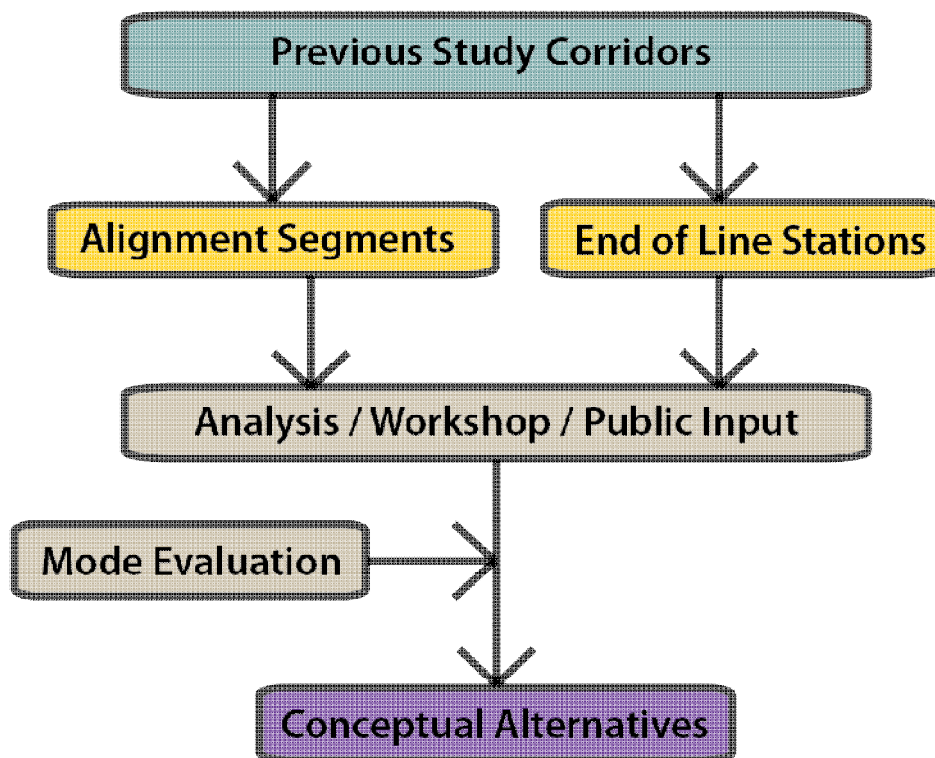
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1.0 Introduction

The “Range of Alternatives” (ROA) for the Arizona Department of Transportation (ADOT) Passenger Rail Corridor Study (APRCS) consists of all reasonable routes, station locations and modes that will be evaluated as part of the study. This memorandum describes the process carried out to develop the initial range of alternatives, details the components of an alternative including alignment segments and stations, summarizes the stakeholder input gained from an interactive ROA workshop and the public scoping process and presents the initial screening results and subsequent bundled conceptual alternatives.

An alternative consists of two system hubs connected by a specific route. The objective of this phase of the study was to consider all unique alignment segments and, upon assessing their contribution to the project’s goals, to combine them into bundled alternatives consisting of alignment, stations and modes. The initial segments utilized in the ROA process were identified based on previous planning initiatives and corridor studies conducted throughout the APRCS study area. The locations of possible system hubs, which in turn define the ends of the study system, were determined from land use and socioeconomic information, as well as agency and public scoping input. The overall process is illustrated in Figure 1.

Figure 1: Range of Alternatives Process



2.0 Previous Study Corridors

All alignment segments used in developing the initial ROA are based on efforts of previous studies. These studies include state-wide transportation plans by ADOT, major corridor studies, as well as transit studies and regional transportation programs of the Maricopa Association of Governments (MAG), the Pima Association of Governments (PAG), and Pinal County. Although many studies have evaluated the corridors represented by these segments, the main sources used to develop the initial APRCS segments were the following:

- ADOT Statewide Transportation Planning Framework Study (bqAZ)
- ADOT North-South Corridor Study
- ADOT I-10 Phoenix / Tucson Bypass Study
- MAG Commuter Rail System Study
- MAG Regional Transportation Program (RTP)
- PAG Regional Transportation Program (RTP)
- Pinal County Comprehensive Plan

These previous study corridors are shown graphically in Figure 2 and Figure 3.

Figure 2: Previous Study Corridors (Northern Study Area)

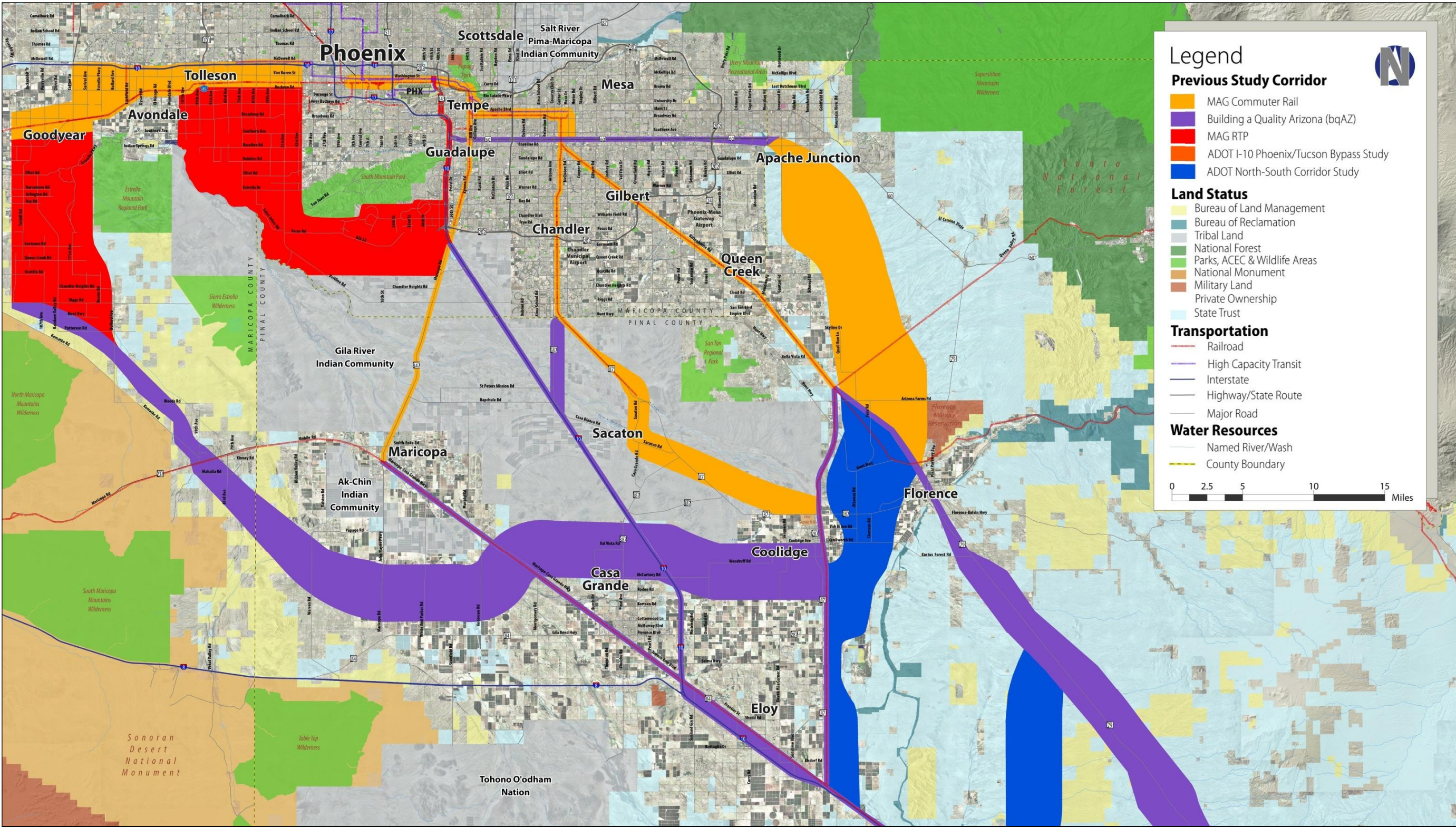
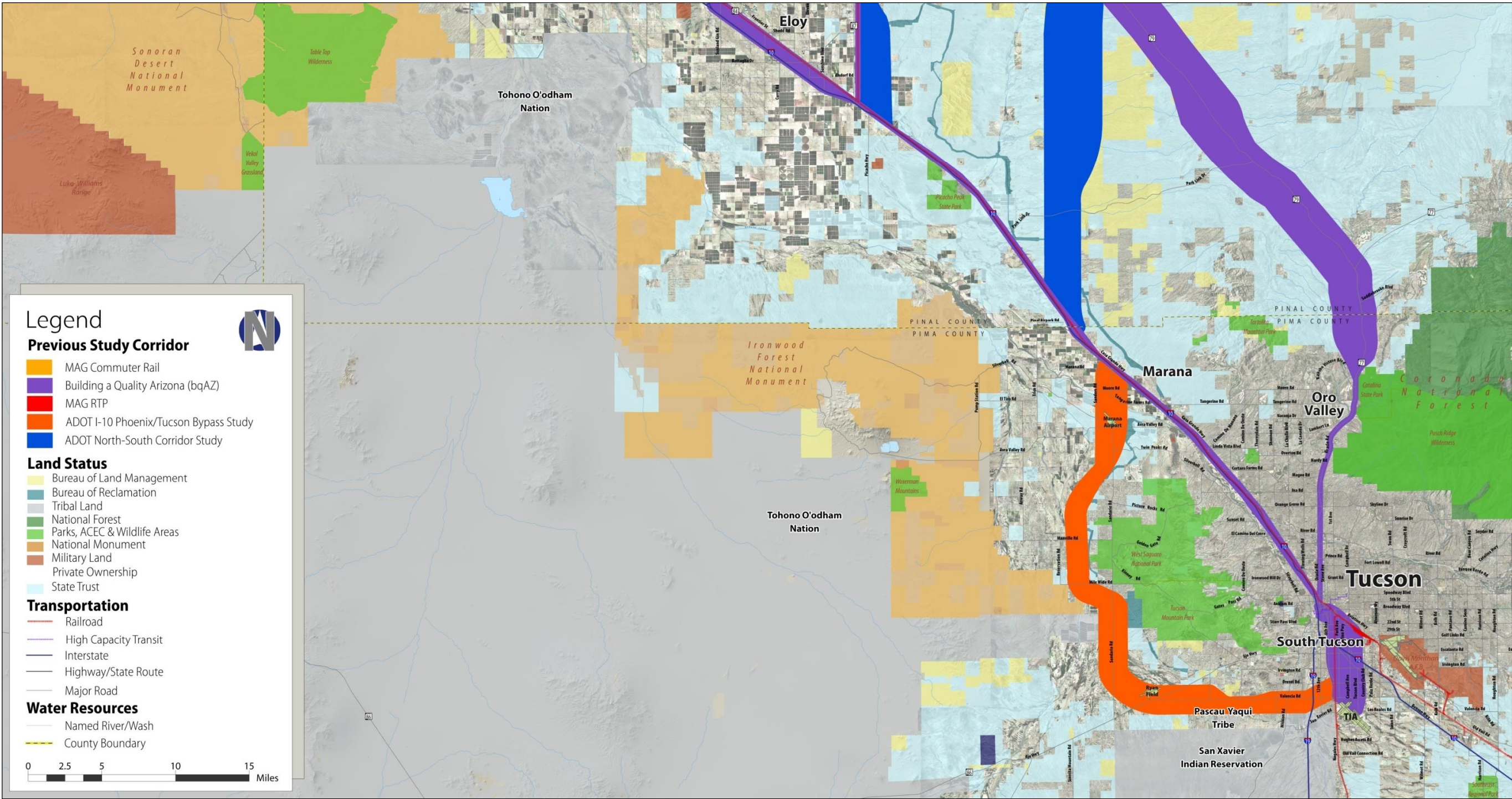


Figure 3: Previous Study Corridors (Southern Study Area)



3.0 Alternatives

The alternatives to be evaluated in the study will reflect those that best meet the Purpose and Need. While not required in an Alternatives Analysis, a No-Build and a Baseline Alternative are required as part of the Tier I EIS process. With that in mind, the federally mandated alternatives are identified now and will be further refined once the Tier I EIS is completed later in the project.

3.1 No-Build Alternative

A No-Build Alternative is required by NEPA to be part of the study process. It includes all transportation facilities and services programmed for implementation within the APRCS study area. This alternative includes roadway and highway improvements identified in the Transportation Improvement Programs (TIPs) of the MAG, Central Arizona Association of Governments (CAAG), and PAG, but no additional significant improvements. Programmed improvements include:

- Interstate 10: Construction of local express lanes between 32nd Street and Loop 202.
- Interstate 10: Roadway widening from four to six general purpose lanes and the addition of an HOV lane from Loop 202 to Riggs Road.
- Interstate 10: Roadway widening and lane additions between Florence Boulevard and State Route 87.
- Interstate 10: Roadway widening from six to eight lanes between Ina Road and Prince Road.
- Interstate 19: Roadway widening from four to eight lanes between San Xavier Road and Interstate 10.
- State Route 77: Roadway widening from four to six lanes between Tangerine Road and the Pima County line.
- Maricopa-Casa Grande Highway: Roadway widening from two to four lanes between State Route 84 and State Route 347.

3.2 Baseline Alternative

A Baseline Alternative includes all programmed transportation facilities and service improvements included in the No-Build Alternative, as well as transportation system management (TSM) enhancements. TSM would include relatively low-cost safety, operational, and capacity enhancements to the existing transportation system. This alternative would not include a major guideway investment and would represent a less-capital intensive improvement strategy to address project goals within the study area. The Baseline Alternative would be mainly focused on increased bus service and selected facility improvements, and serves as the basis of performance comparison in the Federal Transportation Administration's (FTA) "New Starts" grant process.



3.3 Alignment Segments

Forty-three separate alignment segments were identified based on the transportation plans and corridor studies discussed in Section 2.0. The individual segments can be combined to form 151 unique alignments connecting the Tucson and Phoenix metropolitan areas. The segments fall within various county and local government jurisdictions, as well as different types of land ownership classifications including tribal land, State Trust land, and property controlled by the Bureau of Reclamation (BOR) and the Bureau of Land Management (BLM). The segments vary in length from 1.5 miles to 69.1 miles, and also vary in width from a narrow one-quarter mile corridor to a swath over 5 miles wide. Where possible, segments follow an existing or planned transportation corridor such as the Interstate 10 right-of-way, a Union Pacific (UP) Railroad alignment, or alignment options for the concurrent North-South Corridor Study. All alignment segments are shown in Figure 4 and Figure 5 and described in the following section.

Figure 4: Alignment Segments (Northern Study Area)

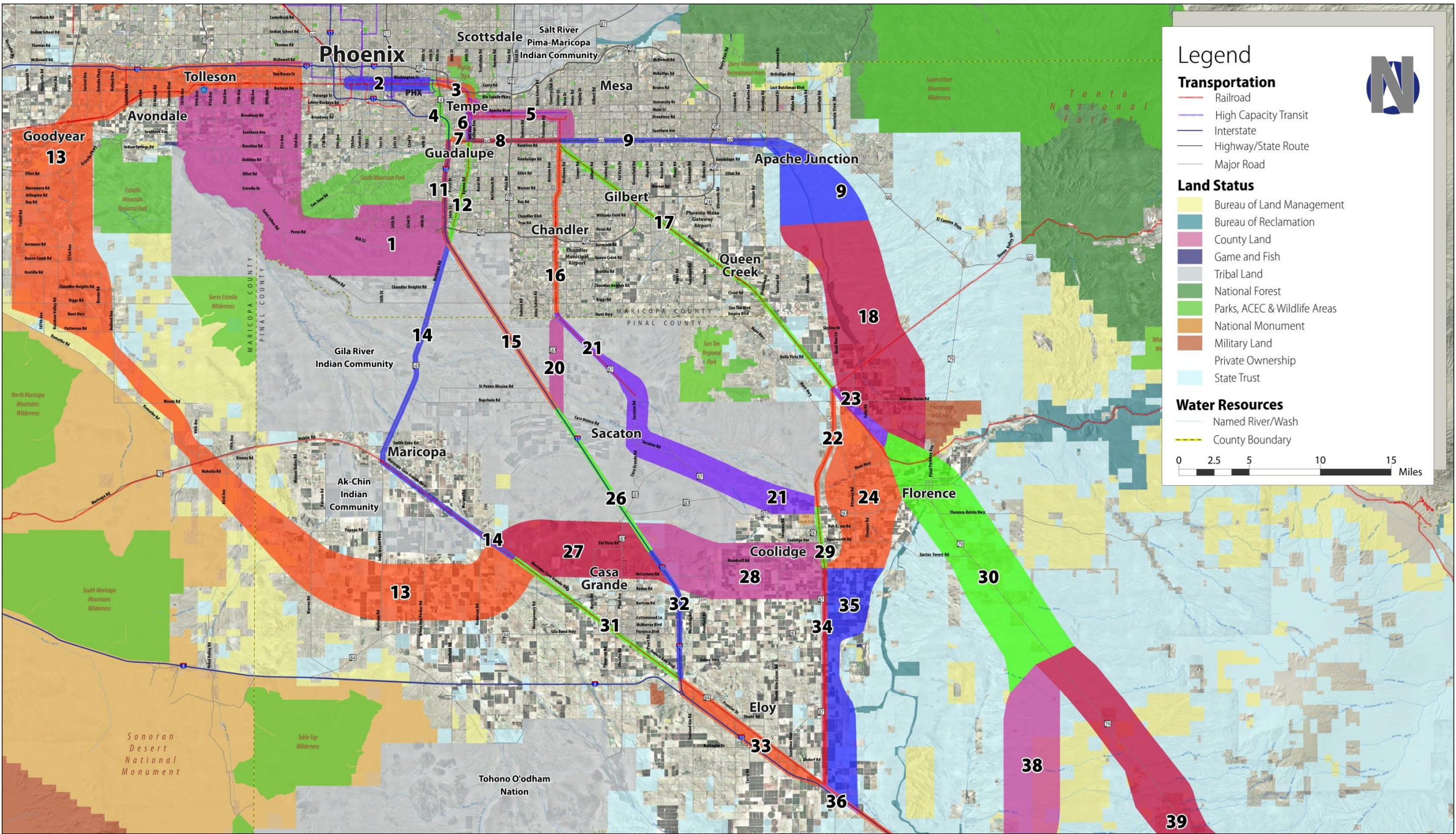
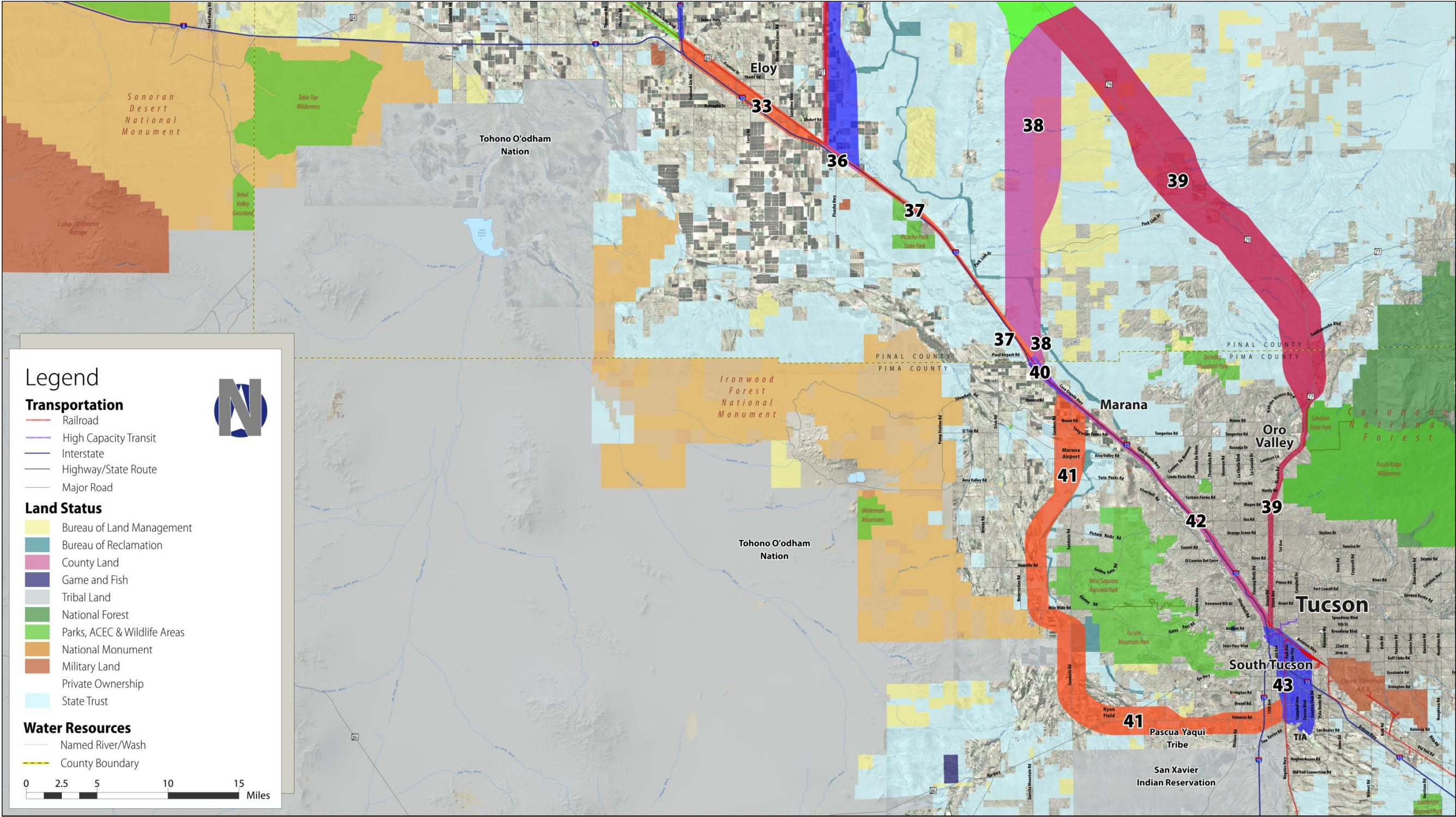


Figure 5: Alignment Segments (Southern Study Area)



3.3.1 Maricopa County Alignment Segments

Sixteen alignment segments fall within Maricopa County. The length of the alignment segments within Maricopa County ranges from 1.5 miles (Segment 7) to 69.1 miles (Segment 13). The 16 segments provide potential access to major features such as Downtown Phoenix, PHX Sky Harbor, Tempe / Arizona State University, as well as Chandler and the Gila River Indian Community. Table 1 provides a breakdown of each Maricopa County alignment segment and describes adjacent jurisdictions, land ownership, other existing or planned transportation alignments within the segment, as well as previous studies that have evaluated that segment.

Table 1: Maricopa County Alternative Segments Summary

Alignment Segment	Length (Miles)	Adjacent Jurisdictions	Land Status	Major Features	Existing/Planned Alignment	Previous Study
1	28.7	Phoenix; Avondale; Gila River Indian Community	Tribal Land	South and west of South Mountain; Wild Horse Pass	SR 202	SR 202 Corridor
2	5.9	Phoenix	Private	Downtown Phoenix; PHX Sky Harbor	UP Rail	MAG Commuter Rail
3	3.9	Phoenix; Tempe	Private	Downtown Tempe	UP Rail	MAG Commuter Rail
4	4.4	Phoenix, Tempe	Private	PHX Sky Harbor	I-10; SR 143	I-10 Widening
5	8.3	Tempe; Mesa	Private	ASU	UP Rail; Metro LR	MAG Commuter Rail; Mesa Extension
6	2.2	Tempe	Private	Downtown Tempe	UP Rail	MAG Commuter Rail
7	1.5	Phoenix; Tempe	Private	Downtown Phoenix	US 60	bqAZ
8	6.0	Tempe; Mesa	Private	None	US 60	bqAZ
9	23.5	Mesa; Apache Junction	State Trust	None	US 60	bqAZ; Superstition Vistas Report
11	7.5	Phoenix, Tempe, Chandler	Private	East of South Mountain Park	I-10	I-10 Widening
12	7.4	Tempe; Chandler	Private	W. Chandler Blvd CBD*; Wild Horse Pass	UP Rail; Tempe Branch	MAG Commuter Rail
13	69.1	Goodyear	BLM	None	Future Interstate	Hassayampa Framework Study
14	27.7	Gila River Indian Community; Maricopa; Ak-Chin Indian Community; Casa Grande	Tribal Land	Downtown Maricopa; Wild Horse Pass	SR 347; Maricopa-Casa Grande Freeway	bqAZ
15	13.9	Gila River Indian Community	Tribal Land	Wild Horse Pass	I-10	I-10 Widening; bqAZ
16	12.3	Chandler; Gilbert	Private	Downtown Chandler	Chandler Branch; UP Rail	MAG Commuter Rail
17	26.3	Gilbert; Mesa; Queen Creek	Private	None	South-East Branch; UP Rail	MAG Commuter Rail

*Central Business District

3.3.2 Pinal County Alignment Segments

Nineteen alignment segments are located within Pinal County. The segments vary in length from 3.1 miles (Segment 36) to 28.3 miles (Segment 19). The Pinal County segments provide potential access to Downtown Florence, Coolidge, Casa Grande, Eloy, Sacaton, and the Central Arizona Community College. Table 2 provides a breakdown of each Pinal County segment and describes adjacent jurisdictions, land ownership, other existing or planned transportation alignments within the segment, as well as previous studies related to that segment.

Table 2: Pinal County Alternative Segments Summary

Alignment Segment	Length (Miles)	Adjacent Jurisdictions	Land Status	Major Features	Existing/Planned Alignment	Previous Study
18	15.0	Queen Creek, Florence	Private	None	North-South Corridor	North-South Corridor Study
20	6.7	Gila River Indian Community	Tribal Land	None	SR 587	bqAZ
21	25.1	Gila River Indian Community	Tribal Land	None	UP Rail Alignment; SR 87	bqAZ
22	9.1	Florence; Gila River Indian Community	State Trust; Tribal Land	None	UP Rail Alignment	bqAZ
23	5.0	Florence	Private	None	UP Rail Alignment	bqAZ
24	10.4	Florence	Private	None	North-South Corridor	bqAZ
26	12.1	Gila River Indian Community; Casa Grande	Tribal Land; State Trust	None	I-10	I-10 Widening; bqAZ
27	9.8	Casa Grande	Private	None	Future Interstate	Hassayampa Framework Study
28	12.6	Coolidge	Private	Central Arizona College	Future Interstate	Hassayampa Framework Study
29	3.8	Gila River Indian Community; Coolidge	Tribal Land	Downtown Coolidge	UP Rail Alignment	bqAZ
30	8.0	Florence	State Trust	Downtown Florence	SR 79	Superstition Scenarios Report
31	14.7	Casa Grande	Private	Downtown Casa Grande	UP Rail Alignment	bqAZ
32	9.8	Casa Grande	Private	None	I-10	I-10 Widening; bqAZ
33	12.5	Casa Grande; Eloy	Private	Downtown Eloy	I-10; UP Rail Alignment	bqAZ
34	15.4	Coolidge; Eloy	Private	None	UP Rail Alignment	bqAZ
35	17.8	Coolidge	State Trust; BOR	None	North-South Corridor	North-South Corridor Study
36	3.1	None	State Trust	None	I-10; UP Rail Alignment	bqAZ
37	18.3	None	State Trust	None	I-10; UP Rail Alignment	bqAZ
38	23.8	Marana	State Trust; BLM	None	East North-South Corridor	North-South Corridor Study

3.3.3 Pima County Alignment Segments

Five alignment segments fall within Pima County. The segments vary in length from 3.9 miles (Segment 40) to 50.9 miles (Segment 39). The segments within Pima County provide access to Marana, Oro Valley, Downtown Tucson, and the Tucson International Airport (TIA). Table 3 provides a breakdown of each Pima County segment and describes adjacent jurisdictions, land ownership, other existing or planned transportation alignments within the segment, as well as related previous studies.

Table 3: Pima County Alternative Segments Summary

Alignment Segment	Length (Miles)	Adjacent Jurisdictions	Land Status	Major Features	Existing/Planned Alignment	Previous Study
39	50.9	Oro Valley; Tucson	State Trust; BLM	West of Coronado National Forest; Downtown Tucson	SR 79; SR 77	bqAZ
40	3.9	Marana	Private	Marana	I-10; UP Rail	bqAZ
41	38.5	Marana; Tucson	State Trust; BOR	West of Saguaro National Park; Downtown Marana	None	PAG RTP I-10 Bypass
42	21.2	Marana; Tucson	Private	Marana; Downtown Tucson	I-10; UP Rail	bqAZ
43	6.8	Tucson; San Xavier Indian Reservation	Private	Downtown Tucson	I-10, I-19, UP Rail Alignment	bqAZ

3.4 Stations

Thirty-eight potential station locations were identified as part of the ROA process. The locations of these potential stations are based on data collection, assessment of existing and future conditions, previous studies, and stakeholder and agency input workshops which are described in Sections 4.0 and 5.0 of this document.

Section 3.4.1 describes the different station types used to create Bundled Alternatives. All potential station locations are described by county in Sections 3.4.2 through 3.4.4.

3.4.1 Station Types

Stations will be paired with segments to create Bundled Alternatives. Different types of stations – System Hub, Regional, and Local -- are proposed according to service characteristics, land use and urban form. An overview of these station types and service characteristics is provided below. Subsequent work tasks will describe the land use and urban form characteristics of each station type in more detail.

System Hub Stations

System hubs serve as an end-of-line station of the passenger rail corridor for both Intercity and Commuter Rail service. Only a select group of locations were identified as potential system hubs. These include Downtown Phoenix, Tempe/ASU, PHX Sky Harbor, Downtown Tucson, and TIA.

Intermediate Stations

Intermediate stations include both regional stations and local stations, as described below.

Regional Stations – Serve Intercity and Commuter Rail service and function as major intermediate stations. Regional stations will have multiple access options, transit supportive land use policies and will be transportation gathering centers for the corridor. The location of the regional stations was determined by considering anticipated travel characteristics and agency and public preferences related to how intercity travel is likely to evolve over time. In general, regional stations are located at downtown locations, a central location in the corridor to aid in gathering and distributing trips, at major commercial airports, and at the edge of the urban areas to serve as a collector location for trips traveling to the opposite end of the corridor.

Local Stations – Serve Commuter Rail only. The function of local stations is to help move daily trips efficiently throughout the corridor. Agencies and the public selected locations that represented the most likely candidates to carry daily trips throughout the corridor based on where major activities are located within each community and their proximity to the identified segments.

Figure 6 and Figure 7 show all 38 potential station locations identified throughout the study area.

Figure 6: Potential Stations (Northern Study Area)

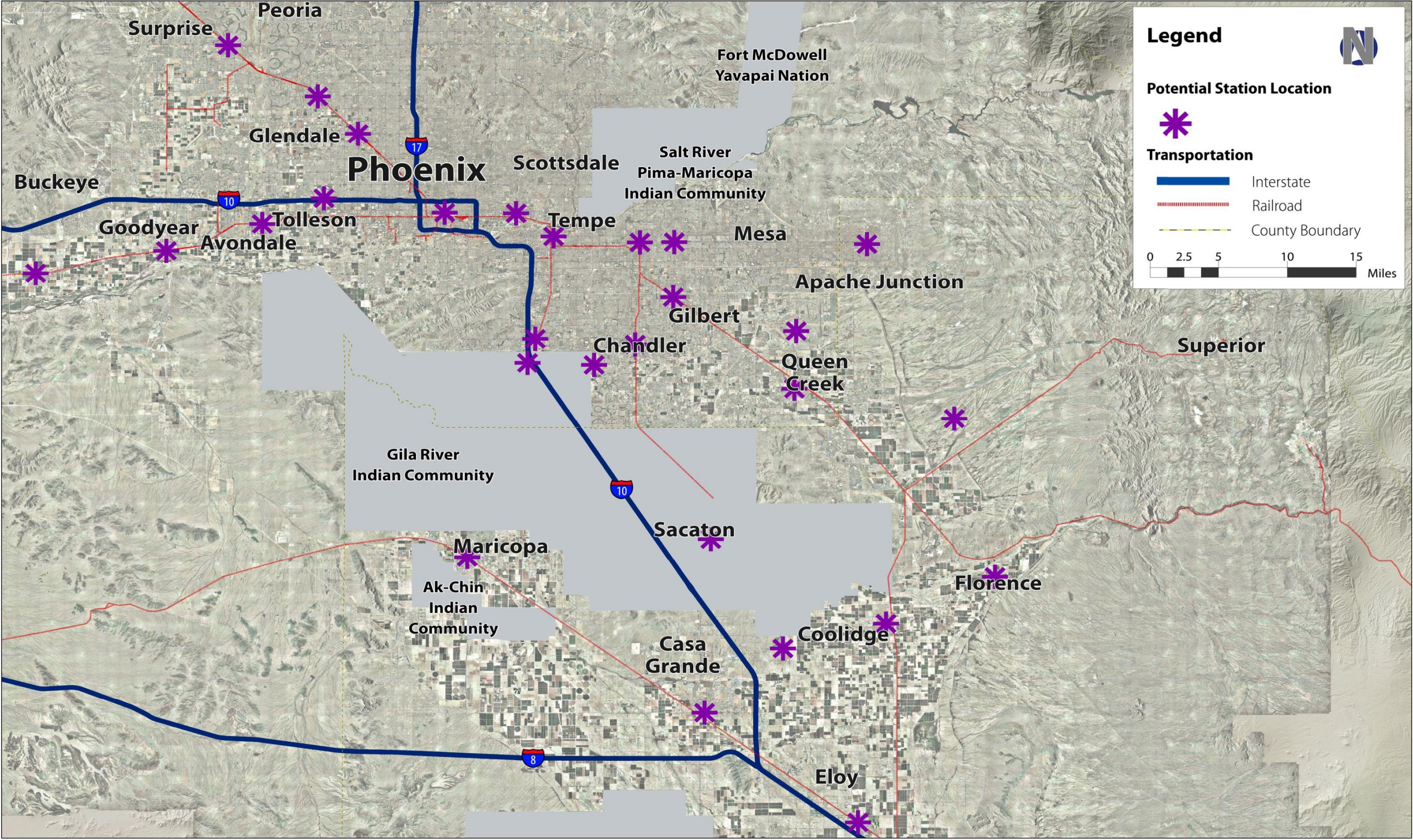
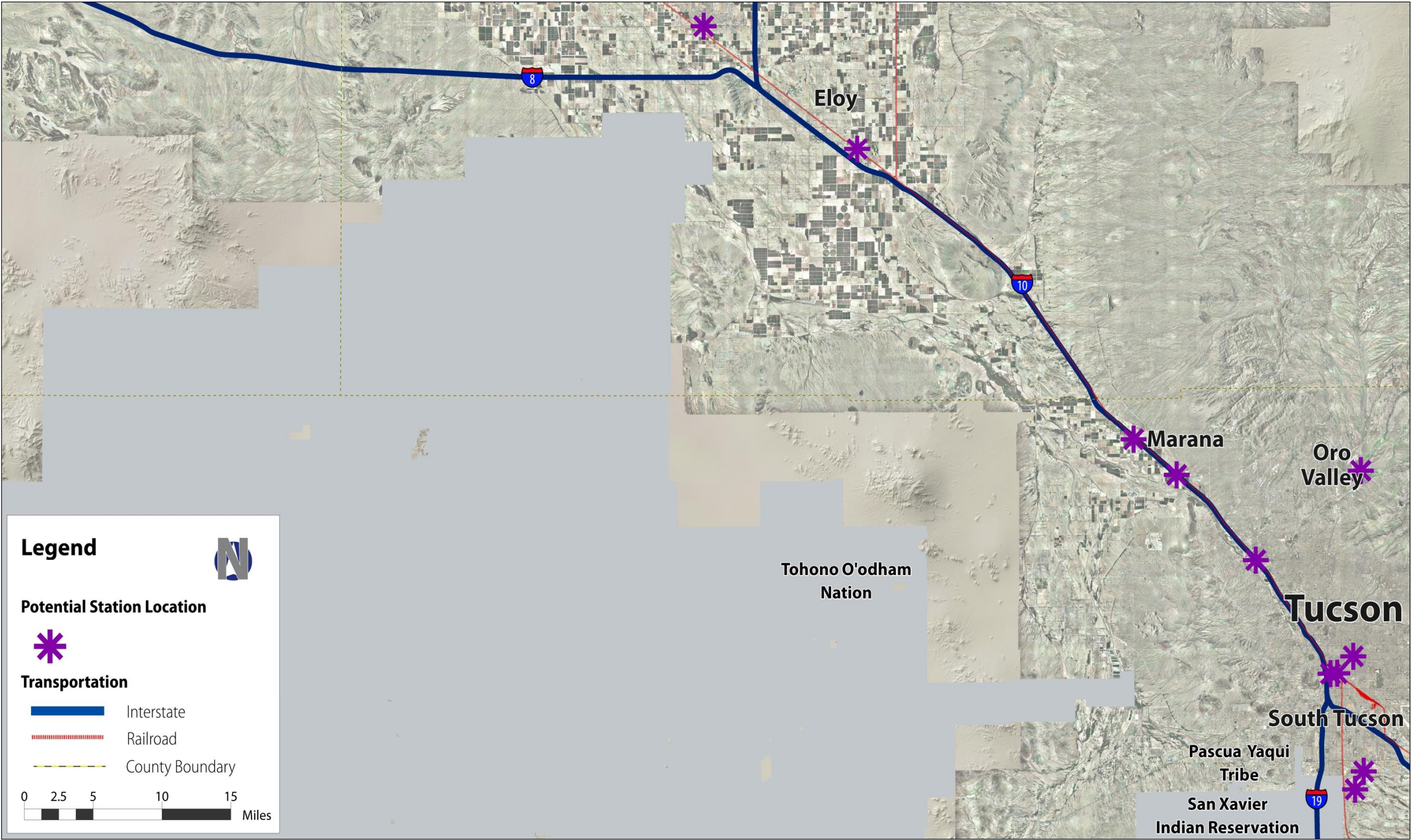


Figure 7: Potential Stations (Southern Study Area)



3.4.2 Maricopa County Stations

Nineteen potential stations have been identified within Maricopa County. Table 4 describes the potential connections that Maricopa County stations have to existing and planned transportation corridors and major activity centers.

Seven locations connect to existing or planned high capacity transit (HCT) systems, including Metro Light Rail, and 16 of the 19 locations are located within illustrative HCT peak corridors described in the MAG RTP. Nine locations also connect to regional bike plan corridors, and eight locations are located adjacent to existing private rail alignments. Major features of the station locations include the MC-85 and US-60 Grand Avenue corridors, along with direct connections to activity centers including the Central Avenue corridor, Downtown Phoenix, ASU, Mill Avenue, Downtown Tempe, Mesa Arts Center, and PHX Sky Harbor.

Table 4: Maricopa County Station Connection Summary

Station	Connects to Planned / Existing HCT	Connects to RTP Illustrative Transit Corridors	Connects to Regional Bike Plan Corridor	Connects to Existing Freight Rail Alignment	Major Features
Avondale	No	Yes	Yes	Yes	MC 85 Corridor
Buckeye	No	Yes	No	Yes	MC 85 Corridor
Chandler	No	Yes	Yes	Yes	Chandler Municipal Center
S. Price Corridor Hi Tech Center	No	No	No	No	Employment Centers
W. Chandler Blvd. CBD	No	Yes	Yes	Yes	SR-202 & I-10 Park-and-Ride
Wild Horse Pass	No	No	No	No	Gila River Indian Community
Gilbert	No	Yes	Yes	Yes	Businesses and entertainment
Glendale	Yes	Yes	No	Yes	US-60 Corridor
Goodyear	No	Yes	No	Yes	MC-85 Corridor
Mesa	No	Yes	Yes	No	Mesa Arts Center / Civic Center
LRT End Station East	Yes	Yes	Yes	No	Downtown Mesa
Phoenix Mesa Gateway Airport	No	No	No	No	Planned Terminal
Peoria	No	Yes	No	No	US-60 Corridor
Downtown Phoenix	Yes	Yes	Yes	No	Businesses and Entertainment
PHX Sky Harbor	Yes	Yes	Yes	No	PHX Sky Harbor Airport
LRT End Station West	Yes	Yes	No	No	I-10 and 79 th Avenue
Queen Creek	No	Yes	No	No	Businesses and Entertainment
Surprise	Yes	Yes	No	Yes	US-60 Corridor
Tempe / ASU	Yes	Yes	Yes	No	ASU Businesses and Entertainment

Source: MAG Regional Transportation Plan (2010 Update), MAG Regional Bike Map (2008)

Table 5 describes the demographic characteristics associated with each Maricopa County station, using a 5-mile circular buffer to represent the station's catchment area. Within the 5-mile area around the station, Glendale has the highest population with 473,130 people and Downtown Phoenix has the highest employment with 438,494 people. Downtown Phoenix and Buckeye share the largest low-income populations at 13%. Downtown Phoenix also has the largest population with zero automobile ownership, and LRT End Station West has the largest minority population among the Maricopa County stations.

Table 5: Maricopa County Station Catchment Area Summary

Station	Population Within 5 Mile Buffer	Employment Within 5 Mile Buffer	% Low Income (Under 25k) Within 5 Mile Buffer	% Zero Auto Ownership Within 5 Mile Buffer	% Minority Population Within 5 Mile Buffer
Avondale	146,272	43,648	6%	3%	41%
Buckeye	28,036	5,568	13%	3%	34%
Chandler	268,853	95,790	4%	3%	24%
S. Price Corridor Hi Tech Center	190,551	81,200	4%	3%	26%
W. Chandler Blvd. CBD	160,763	102,779	4%	3%	26%
Wild Horse Pass	102,745	68,327	3%	2%	24%
Gilbert	357,349	116,076	5%	5%	25%
Glendale	473,130	120,298	8%	9%	41%
Goodyear	41,947	8,447	8%	3%	32%
Mesa	354,700	132,374	8%	7%	28%
LRT End Station East	339,922	114,315	7%	6%	25%
Phoenix Mesa Gateway Airport	80,845	10,325	4%	12%	37%
Peoria	298,071	81,514	8%	7%	28%
Downtown Phoenix	361,949	438,494	13%	14%	47%
PHX Sky Harbor	310,313	353,611	12%	2%	17%
LRT End Station West	311,937	76,932	7%	7%	49%
Queen Creek	65,488	7,146	4%	2%	22%
Surprise	176,430	26,855	9%	4%	17%
Tempe / ASU	303,518	308,421	11%	9%	34%

Source: Demographic data originates from the AZ Statewide Model at the Traffic Analysis Zone (TAZ) level, and 2010 US Census

3.4.3 Pinal County Stations

Nine potential stations have been identified within Pinal County. Table 6 describes the potential connections of each station to existing and planned transportation corridors and major activity centers. No locations connect to existing or planned HCT systems, while four locations are located within illustrative HCT corridors described in the Pinal County Multimodal Circulation Plan. Five locations also connect to designated multi-use trail corridors, and five locations are located adjacent to existing private rail alignments. Major features of the station locations include the Interstate 10 and North-South Corridor Study corridors, along with direct connections to the downtown businesses of Apache Junction, Casa Grande, Coolidge, Florence, Maricopa, and Sacaton.

Table 6: Pinal County Station Connection Summary

Station	Connects to Planned / Existing HCT	Connects to Circulation Plan Illustrative Transit Corridors	Connects to Regional Bike Plan Corridor	Connects to Existing Freight Rail Alignment	Major Features
Apache Junction	No	No	Yes	Yes	Downtown Businesses
Casa Grande	No	No	Yes	Yes	Downtown Businesses
Central Arizona College	No	No	No	No	Campus Facilities
Coolidge	No	Yes	No	Yes	Downtown Businesses
Eloy	No	Yes	Yes	Yes	I-10 Corridor
Florence	No	Yes	Yes	No	Downtown Businesses
Maricopa	No	Yes	Yes	Yes	Downtown Businesses
Sacaton	No	No	No	No	Downtown Businesses
Superstition Vistas (Future Activity Center)	No	No	No	No	North-South Study Corridor

Source: Pinal County Comprehensive Plan (2009)

Table 7 describes the demographic characteristics associated with each Pinal County station, using a 5-mile circular buffer to represent the station's catchment area. Within the 5-mile area around the station, Apache Junction has the highest population with 90,645 people, while employment was highest in Casa Grande at 16,123 employees. Sacaton has the largest low-income and minority populations with 12% and 81%, respectively. Coolidge and Casa Grande share the highest zero automobile ownership households within all Pinal County stations.

Table 7: Pinal County Station Catchment Area Summary

Station	Population Within 5 Mile Buffer	Employment Within 5 Mile Buffer	% Low Income (Under 25k) Within 5 Mile Buffer	% Zero Auto Ownership Within 5 Mile Buffer	% Minority Population Within 5 Mile Buffer
Apache Junction	90,645	13,869	9%	6%	12%
Casa Grande	51,020	16,123	8%	8%	32%
Central Arizona College	9,282	1,762	5%	7%	37%
Coolidge	16,077	2,833	9%	8%	38%
Eloy	10,556	1,796	10%	7%	43%
Florence	8,064	4,372	8%	5%	31%
Maricopa	41,555	3,158	9%	4%	36%
Sacaton	3,780	1,527	12%	4%	81%
Superstition Vistas (Future Activity Cetner)	5,666	152	6%	2%	19%

Source: Demographic data originates from the AZ Statewide Model at the Traffic Analysis Zone (TAZ) level, and 2010 US Census

3.4.4 Pima County Stations

Ten potential stations have been identified within Pima County. Table 8 describes the potential connections of these stations to existing and planned transportation corridors and major activity centers. Three Downtown Tucson locations connect to an existing or planned HCT system and eight locations connect to planned transit corridors described in the PAG RTP. The three Downtown Tucson stations connect to a regional bike plan corridor, and five of the total locations are located adjacent to existing private rail. Major features of stations within Pima County include the Interstate 10 and State Route 77 corridors, along with direct connections to major activity centers such as TIA, Downtown Tucson, and the University of Arizona.

Table 8: Southern Station Connections Summary

Station	Connects to Planned / Existing HCT	Connects to RTP Illustrative Transit Corridors	Connects to Regional Bike Plan Corridor	Connects to Existing Freight Rail Alignment	Major Features
Marana (Ina Rd / I-10)	No	Yes	No	Yes	I-10 Corridor
Marana (Marana Rd / Sandario Rd)	No	Yes	No	Yes	I-10 Corridor
Marana (Tangerine Rd / I-10)	No	Yes	No	Yes	I-10 Corridor
Oro Valley	No	Yes	No	No	SR-77 Corridor Commercial Center
Historic Train Depot	Yes	Yes	Yes	Yes	Businesses and Entertainment
Raytheon	No	No	No	No	Employment Center
Rio Nuevo	Yes	Yes	Yes	No	Businesses and Entertainment
Tucson International Airport	No	Yes	No	No	TIA Airport Facilities
University of Arizona	Yes	Yes	Yes	No	Campus Facilities
U of A Research Center	No	No	No	Yes	Employment Center

Source: PAG 2040 Regional Transportation Plan

Table 9 describes the demographic characteristics associated with Pima County stations, using a 5-mile circular buffer to represent the station's catchment area. Within the 5-mile area around the station, Historic Depot has the highest population with 281,495 people and University of Arizona has the highest employment with 186,525 people. All three Downtown Tucson locations share the highest percentage of low income population and zero automobile ownership with 19% and 13%, respectively. The Raytheon station location has the largest percentage of minority population of all Pima County stations with 43%.

Table 9: Southern Station Catchment Area Summary

Station	Population Within 5 Mile Buffer	Employment Within 5 Mile Buffer	% Low Income (Under 25k) Within 5 Mile Buffer	% Zero Auto Ownership Within 5 Mile Buffer	% Minority Population Within 5 Mile Buffer
Marana (Ina Rd / I-10)	4,564	3,867	6%	2%	17%
Marana (Marana Rd / Sandario Rd)	8,730	4,135	7%	3%	17%
Marana (Tangerine Rd / I-10)	17,079	5,182	6%	3%	16%
Oro Valley	39,897	7,152	4%	2%	11%
Historic Depot	281,495	167,558	19%	13%	32%
Raytheon	100,142	40,100	13%	9%	43%
Rio Nuevo	270,865	157,257	19%	13%	33%
Tucson International Airport	113,898	54,520	14%	9%	42%
University of Arizona	277,862	186,525	19%	13%	30%
University of Arizona Research Center	27,458	19,281	7%	3%	24%

Source: Demographic data originates from the AZ Statewide Model at the Traffic Analysis Zone (TAZ) level, and 2010 US Census

3.5 Modes

Three transportation modes were examined to connect Tucson and Phoenix metropolitan areas: bus, rail and air. Personal auto was not considered as a mode in this analysis because it has been and is being addressed as part of other studies within the region, such as the North-South Corridor Study. The characteristics and feasibility of each mode are detailed below.¹

Bus

Average Cost per Mile: \$0.92

CO2 Emissions: 56 g/pass-mile

Energy Use : 749 BTU/pass-mile

Implementation Status: No current plans for exclusive right-of-way for buses between Tucson and Phoenix. There is existing bus service on I-10.

Potential Service Characteristics: Opportunity for stations in many intermediate communities between Tucson and Phoenix, offering a range of connection options.

Rail

Average Cost per Mile: \$0.63

CO2 Emissions: 160 g/pass-mile

Energy Use: 1850 BTU/pass-mile

Implementation Status: Rail connection between Tucson and Phoenix identified in State Rail Plan.

Potential Service Characteristics: Opportunity for stations in a limited number of communities between Tucson and Phoenix.

Air

Average Cost per Mile: \$16.13

CO2 Emissions: 243 g/pass-mile

Energy Use: 3260 BTU/pass-mile

Implementation Status: No current plans for expansion of air service between Tucson and Phoenix.

Potential Service Characteristics: Limited to stations in Mesa, Phoenix, and Tucson.

Due to the cost and limited service characteristics of air, only the bus and rail modes were advanced.

¹ Bureau of Transportation Statistics, 2011

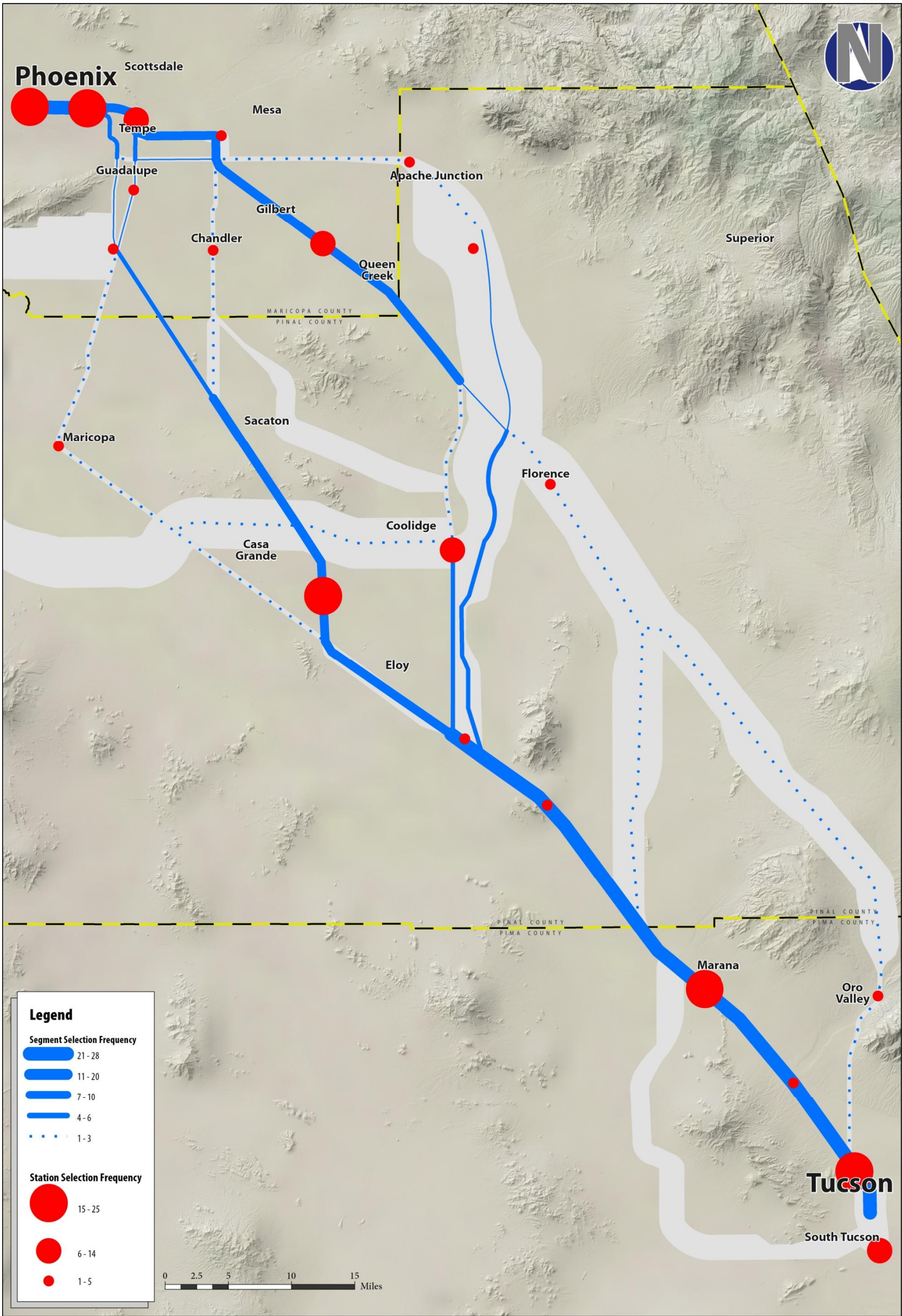
4.0 Community Support Team Meetings – Workshop Summary

In June 2011, three separate Corridor Support Team (CST) meetings were held as part of the Study where agency representatives throughout the corridor were invited to participate in the development of the range of alternatives for this study. The goal of these meetings was to inform stakeholders of the purpose of the study, as well as to gain valuable input that could be utilized throughout the project. The meetings were held at three separate locations: Tucson, Coolidge, and Phoenix, and included several work sessions focusing on different aspects of the study.

A ROA workshop was held as part of each CST meeting. In this session, participants were divided into small groups, and provided with a map of the overall study area which included outlines of the alignment segments identified in previous transportation studies. The groups were asked to identify potential rail alignments and potential station locations using string, stickers, and markers. Groups were also asked to record the overall purpose or goal of each alignment, as well as the type of service (local service or express service) which would best serve that purpose.

This section is a summary of the information gathered from each CST meeting. It also contains breakdowns on the frequency with which specific alignments and station locations were identified by workshop participants. Figure 8 shows the overall total results of the three ROA workshops, including the frequency with which alignment segments and stations were selected.

Figure 8: ROA Workshop Results Summary



4.1 Northern CST

The Northern CST meeting, held in Phoenix, had the highest attendance, with seven separate groups participating in the ROA workshop. These groups identified local service alignments with an average length of 120 miles, and an average travel time of 86 minutes. The participants also located an average of 3.6 stations per alignment. The groups also identified an express service, which would follow the same alignment as local service but with fewer intermediate stops and a faster travel time. The express option had an average of 1.6 stations and average of 71 minutes of travel time. A number of trip purposes or goals were recorded for each potential alternative. The most common of these were:

- Creating a commuter route connected to residential areas;
- Creating connections to future and existing employment centers; and
- Providing connections to airports and future light rail / BRT systems.

The overall results for the Northern CST are summarized in Table 10 and Table 11. These tables summarize the recommendations by the workshop participants, detailing the overall recommended alignment and the number of times a specific station location was desired, respectively.

Table 10: Northern CST Alignment Results Summary

	Local Service	Express Service
Average Distance (miles)	120	120
Average Travel Time (min)	86	71
Average Number of Intermediate Stations	3.6	1.6
Stated Trip Purposes	<ul style="list-style-type: none"> - Commuter route connected to residential areas - Connections to future and existing employment centers - Modal connections to airports and future light rail / BRT 	

Table 11: Northern CST Desired Station Location Summary

Location	Station Type		
	System Hub	Intermediate Station	
		Local Service	Express Service
Downtown Phoenix	9		
PHX Sky Harbor	2	4	3
Tempe/ ASU	1	3	
South Tempe	1		
Chandler		1	
Williams - Gateway		4	1
Wildhorse Pass		1	
Maricopa		2	
Casa Grande		6	1
Florence		2	
Coolidge		3	2
Eloy		2	
Marana		12	
Downtown Tucson	8	1	
Tucson International Airport	5		

In the Northern CST, the most desired system hub locations were Downtown Phoenix and Downtown Tucson. The most desired intermediate stations were PHX Sky Harbor, Tempe/ASU, Williams-Gateway, Casa Grande, and Marana. Phoenix Sky Harbor and Coolidge were the most desired intermediate stations for express service.

Along with specific alignments, station locations, and trip purposes, general comments and observations were sought from participants. In the Northern CST ROA workshop, these general comments included a discussion of how system hubs should be multi-purpose in nature, and should serve different markets for employment and entertainment centers, and offer adequate parking for commuter trips. There was also an emphasis placed on connecting the future alignment to existing and planned transportation infrastructure. Specific examples included Amtrak, proposed streetcars, airports, park-and-ride facilities, and carsharing locations.

Other considerations suggested included working closely with Native American Communities and minimizing harmful impacts on sensitive wildlife areas. Comments also represented the debate of whether the proposed system should consider future growth, or focus on areas with existing population and employment centers.

4.2 Central CST

The Central CST meeting was held in Coolidge, with three groups participating in the ROA workshop. The participants identified several alignment alternatives with an average distance of 128 miles, an average travel time of 94 minutes for local service, and 78 minutes for express service, where the express service would follow the same alignment as local service, but with fewer intermediate stops resulting in a

shorter travel time. The alignments included an average of 3.6 station locations per alternative for local service, and 1.5 for express service. Participants voiced their opinions on various trip purposes, which included:

- A connection to employment and residential centers;
- Serving existing population centers;
- Having the highest overall travel speed;
- Maximizing connections and service area; and
- The service of existing and future employment centers.

The overall results for the Central CST are summarized in Table 12 and Table 13. These tables summarize the recommendations by the workshop participants, detailing the overall recommended alignment and the number of times a specific station location was desired, respectively.

Table 12: Central CST Results Summary

	Local Service	Express Service
Average Distance (miles)	128	128
Average Travel Time (min)	94	78
Average Number of Intermediate Stations	3.6	1.5
Stated Trip Purposes	<ul style="list-style-type: none"> - Connections to employment and residential centers - Serve existing population - Highest overall speed - Maximize connections - Serve existing and future employment centers 	

Table 13: Central CST Desired Station Location Summary

Location	Station Type		
	System Hubs	Intermediate Station	
		Local Service	Express Service
Downtown Phoenix	4		
PHX Sky Harbor	2		
Tempe/ ASU			1
Williams - Gateway		2	
Wildhorse Pass		1	
Apache Junction		1	
Maricopa		1	
Casa Grande		3	1
Coolidge		2	1
Eloy		4	
Marana		6	
Downtown Tucson	4	2	
Tucson International Airport	2		

Downtown Phoenix and Downtown Tucson were the most desired system hub locations for the Central CST. The most desired intermediate stations were Casa Grande, Eloy, and Marana. The intermediate stations identified for express service were Tempe/ASU, Casa Grande, and Coolidge.

Comments received during the Central CST meeting heavily emphasized connecting residential and employment centers. Comments also stated repeatedly that the future system must accommodate both existing and future populations, mentioning the North South Corridor specifically as an opportunity to serve the largest potential future population. However, other discussion focused on the importance of existing populations, going as far as to suggest population percentage within a certain distance of an alignment as an important evaluation criterion.

4.3 Southern CST

The Southern CST meeting was held in Tucson, with four groups participating in the ROA workshop. The participants of Southern CST identified routes with an average distance of 126 miles, and average travel time of 96 minutes for local service, and an average express service travel time of 76 minutes. Local service alignments had an average of 4.8 stations, while express alignments had an average of 1.3. The purposes and goals of Southern CST alignments included:

- The prioritization of commuter service;
- Serving employment centers;
- Serving existing populations;
- Providing opportunities for in-fill development;
- Creating multi-modal connections; and
- The creation of a primarily inter-city system, connecting the edges of urban areas.

The overall results for the Southern CST are summarized in Table 14 and Table 15. These tables summarize the recommendations by the workshop participants, detailing the overall recommended alignment and the number of times a specific station location was desired, respectively.

Table 14: Southern CST Results Summary

	Local Service	Express Service
Average Distance (miles)	126	126
Average Travel Time (min)	96	76
Average Number of Intermediate Stations	4.8	1.3
Stated Trip Purposes	<ul style="list-style-type: none"> - Commuter service - Connect to edges of urban areas - Primarily inter-city - Serve employment centers - Serve existing population, in-fill development - Multi-modal connectivity 	

In the Southern CST the most desired system hub locations were Downtown Phoenix and the Tucson International Airport. The most desired intermediate station locations were PHX Sky Harbor, Casa Grande, Marana, and Downtown Tucson. The intermediate stations identified for express service were Mesa (light rail terminal), Casa Grande, Florence, and Downtown Tucson.

The participants in the Southern CST ROA workshop also offered differing comments regarding whether the future rail system should focus on existing or future populations, repeatedly mentioning the future growth projections along the North South corridor. Other comments included how proposed alignments should avoid conflicts with existing Union Pacific Railroad corridors, and how the TIA provides an important multi-modal connection. The ideas of speed and efficiency were also reiterated, suggesting that too many stops, or too long of an overall travel time would make the system less attractive to travelers.

Table 15: Southern CST Desired Station Location Summary

Location	Station Type		
	System Hub	Intermediate Station	
		Local Service	Express Service
Downtown Phoenix	7		
PHX Sky Harbor	1	3	
Mesa (Center St & Main St)			1
Chandler		1	
Williams - Gateway		2	
Wildhorse Pass		1	
Apache Junction		1	
Casa Grande		3	1
Coolidge		2	
Florence		1	1
Picacho		1	
Marana		5	
Oro Valley		1	
Tangerine Road		1	
Downtown Tucson	3	3	1
Tucson International Airport	5		

4.4 Corridor Selection Frequency

The specific alignments identified in each ROA workshop included a wide range of potential routes and alternatives. However, the majority of the alignments identified fell into a set of existing or planned transportation corridors discussed and analyzed in previous transportation studies within the region. For the purposes of this study, a corridor is a specifically identified linear area which could potentially accommodate a HCT system. These major corridors include:

- The existing Interstate 10 corridor between Tucson and Phoenix;
- The North South Corridor in eastern Pinal County connecting to Interstate 10 near Eloy;
- The Southeast branch of the Union Pacific Railroad (stretching approximately from Florence, through Queen Creek and Gilbert, to Phoenix in the northwest) in conjunction with the Sunset Line or Interstate 10 south of Eloy;
- The UP corridor running north-south through Chandler and connecting to the Sunset Line or Interstate 10 south of Eloy,
- The Maricopa corridor, which utilizes the Maricopa – Casa Grande Highway and State Route 347 connecting to Interstate 10, and
- The corridor following State Route 79 connecting to the UP Southeast Branch or State Route 60.

Table 16 describes the frequency that each of these corridors was chosen for potential intercity rail alignments in each of the ROA workshops. Overall, the Interstate 10 and North South Corridor were identified most often, with the Southeast Branch also receiving high scores. It is important to note that these corridors are not mutually exclusive, and that portions of two or more could be utilized in the same alignment.

Table 16: Corridor Selection Frequency

Corridor	North	Central	South	Total
Interstate 10	5	4	3	12
North South Corridor	6	3	3	12
Southeast Branch	6	3	2	11
Chandler	1		2	3
Maricopa	1	1		2
State Route 79			1	1

4.5 Potential Station Location Selection Frequency

The potential station locations identified in the three ROA workshops varied. However, some station locations were chosen more often than others. Table 17 below shows a breakdown of each potential station location, and the frequency with which it was chosen throughout the ROA workshop process. The totals listed in the table include system hubs, intermediate stations for local service, and intermediate stations for express service. It is important to note that these locations are broad generalized areas, and should not be interpreted as specific sites or properties.

Table 17: Total Station Location Selection Frequency

Location	Station Type		
	System Hub	Intermediate Station	
		Local Service	Express Service
Downtown Phoenix	20		
PHX Sky Harbor	5	7	3
Tempe/ ASU	1	3	1
Mesa (Center St & Main St)			1
South Tempe	1		
Chandler		2	
Williams - Gateway		8	1
Wildhorse Pass		3	
Apache Junction		2	
Maricopa		3	
Casa Grande		12	3
Coolidge		6	4
Florence		3	1
Eloy		6	
Picacho State Park		1	
Marana		23	
Oro Valley		1	
Tangerine Road		1	
Downtown Tucson	15	6	1
Tucson International Airport	12		

In total, among all ROA workshops, Downtown Phoenix, Downtown Tucson, and the Tucson International Airport were the most desirable system hub locations. The most desired intermediate stations for local service were PHX Sky Harbor, Williams-Gateway, Casa Grande, Coolidge, Eloy, Marana, and Downtown Tucson. The intermediate stations desired for express service were PHX Sky Harbor, Casa Grande, and Coolidge.

5.0 Scoping

Public scoping was conducted between October 7th and November 1st, 2011. During the scoping process the project team conducted 12 scoping events throughout the study area and received feedback on the project. Details of the scoping process are detailed in the *Scoping Report*.

No additional routing options or potential stations were identified during scoping. Participants confirmed the proposed potential stations and alignments to be examined as part of this study process.

6.0 Initial Screening

The initial screening process was conducted evaluating the route locations, stations and service types. The screening of route alignments focused on the potential route locations using detailed analysis parameters in the categories of infringement on sensitive environments, length, potential ridership, institutional considerations, existing transportation uses, and compatibility with local land use plans. The screening of potential station locations was conducted for both commuter and intercity station locations using analysis parameters related to potential transportation connections and travel markets.

The screening process is detailed in the *Initial Screening Working Paper*.

7.0 Bundled Alternatives

Stations and alignments were combined to create bundled alternatives based on results of initial screening. The bundled alternatives, described below, connect Tucson and the Phoenix area with various system hub locations throughout each region. The alignments follow the segments previously identified with stations connecting the core areas of existing and future population and employment centers.

The bundled alternatives include the following:

- I-10 HOV/Busway - utilize exclusive guideway and HOV improvements on I-10 to provide bus service connecting Tucson to Phoenix.
- UP - utilize the existing UP rail corridor between Tucson to Phoenix.
- I-10 - utilize the I-10 corridor between Tucson and Phoenix.
- North-South/UP Southeast Branch – utilize the I-10 corridor to the new North South Corridor, connecting to the UP Southeast Branch into Phoenix.
- I-10/UP Chandler Branch - utilize either the I-10 or UP Sunset Line right of way between Tucson and Casa Grande, north to Sacaton to connect to the UP Chandler Branch.
- Central Pinal/Eastern Maricopa - utilize the I-10 corridor to the new North South Corridor, connecting to the US 60 corridor.
- Western Pinal/UP Tempe Branch - utilize either the I-10 or UP Sunset Line right of way between Tucson and Casa Grande, traverse west to connect to the City of Maricopa and then north to the UP Tempe Branch, ending in Downtown Tempe.

The bundled alternatives will be refined in the Alternatives Analysis process.

8.0 Next Steps

The ROA process introduces all possible route alignments and system hub locations that have been evaluated as part of the APRCS study process. The information from the ROA process will be utilized in the Alternatives Analysis.